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ABSTRACT

This teacher's manual is designed to supplement the student manual for a unit of study on topographic map and compass use. The beginning section of the manual discusses (1) teaching strategy and evaluation, (2) teaching time and facilities, (3) materials and equipment required, (4) suggested field experience, (5) setting up a compass competition, and (6) setting up an orienteering race. The bulk of the manual is made up of eight student exercise sheets (with answers), which are also found in the student manual. The exercises cover the following topics: identifying topographic map symbols, determining distances, reading a topographic map, determining topographic profiles, naming topographic features, naming directions, avoiding obstacles, and taking bearings on a topographic map. The last part of the manual provides a final exam for the unit. A topographic map symbol sheet and three overhead masters are appended. (LRA)

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Topographic Map & Compass Use

A teaching packet to supplement the student manual

By Michael Taylor

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A full-color topographic map symbol sheet and three overhead masters can be found in the pocket on the inside back cover.

The intent of the manual is to introduce the student to topographic maps and compass use through text readings and exercises. No prerequisite knowledge of the subject-matter area is necessary, but previous coursework in earth science and geometry is helpful.

Teaching strategy and evaluation

Developing orienteering skills depends on practice, so emphasis must be placed on student activity. A recommended teaching strategy is student readings followed by class lectures, in-class demonstrations, field experiences, and completion of student exercises. The following aids are provided in this packet:

- teaching suggestions
- a list of suggested field experiences
- an outline for conducting a compass walk and an orienteering race
- completed student exercises
- a comprehensive exam
- three overhead transparency masters: orienteering compass, topographic map, magnetic north lines (to lay over the topographic map)

The test can be used with any topographic map. An answer key to correspond to the map must be prepared by the teacher. Student achievement of the objectives can be assessed on the basis of student exercises, supervised activities, and the comprehensive test.

Teaching time and facilities

Seven two-hour class sessions should be sufficient time to work through the five units, although this will vary slightly with class size and students' interests.

The units can be taught with a minimum of facilities—just classroom space and a small land area for student practice of orienteering skills. Large parcels of land with a variety of physical and cultural features will provide the students with more experience.

Materials and equipment required

Units 1–3, 5

- topographic maps of the local area, one per four students
- other topographic maps, one per four students
- 8" x 11" self-locking freezer bags
- overhead projector

Unit 3

- string, 6 inches per student

Unit 4

- overhead projector
- orienteering compasses, one per four students

Unit 5

- rulers, one per student
- orienteering compasses, one per four students

Suggested field experiences

1. Using a compass, students point out the eight principal directions.
2. Students take bearings to natural and cultural landmarks. (For example: "What is the bearing to North Hill?")
3. Students orient their topographic map and locate landforms and cultural features.
4. Using a compass and two identifiable landforms (or cultural features), students find their location on a topographic map.
5. Students participate in a compass competition and an orienteering race.

Setting up a compass competition

A compass walk will give the students practice in following a bearing with precision. Lay out the course in a wooded area by tacking

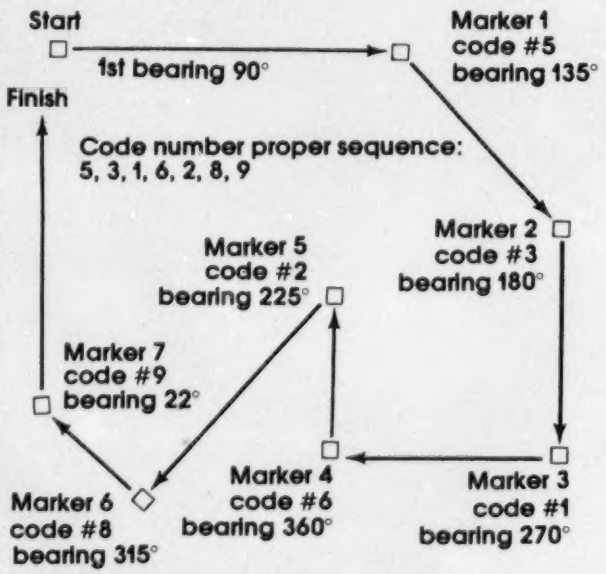


Figure 1. A typical course for a compass competition.

a series of markers to trees. The markers each have a code number and direction to the next marker. To complete the compass walk correctly, the student must find and record the code numbers in the proper sequence.

A variation of the compass walk is the compass race where students, in groups of two to four, compete with other groups for the shortest completion time. Having the students identify environmental components—trees, shrubs, animal habitats—adds interest and challenge to a walk or race.

Materials needed:

3 x 5 cards, one per bearing
tacks, one per card
felt-tipped pen
orienteering compass, one per two to four students

Procedure:

1. Decide on length of course and draw an approximation of its layout. (The layout should be in a zig-zag pattern.)
2. Select a woods area. (Avoid areas where students may get lost.)
3. On the card, write the code number and next bearing. (Be sure to record the code number sequence.)
4. Tack card on a tree at eye level. (A plastic bag or clear contact paper will protect cards from moisture.)
5. Follow the designated bearing for the next marker at least 100 yards.
6. Repeat steps 3 through 4 until the course is completed.

Setting up an orienteering race

An orienteering race motivates students to master the use of the compass and topo. map. It also provides an opportunity to evaluate the student's ability.

The student's success in the competition depends on four factors: (1) correctly following instructions, (2) carefully planning routes, (3) accurately using the compass and map, and (4) completing the course quickly. Emphasize that speed is only one factor. The fast runner who takes one inaccurate bearing will probably finish last.

Materials needed:

topo. maps, one per participant
orienteering compass, one per participant
red-and-white markers, one per control point
3" x 5" cards, one per participant or team
pencils, one per participant or team
watch

Procedure:

1. Select on a map a suitable area for the race. The area should be well wooded with several easily identifiable landmarks. There should be no hazardous cliffs or bogs.
2. Obtain permission from the landowner(s) to cross the property.
3. On the map, select a number of easily identifiable landmarks (natural or artificial) to establish as control points. For beginners, a 1-1/2 to 2-1/2 mile course is recommended.
4. On the map, circle the locations of the control points and mark the order which they should be visited.
5. In the field, place a red-and-white marker at the location of the control points. Write a code number on each marker.
6. Post the marked map near the starting line.
7. Give each participant a topo. map for the area, a description of the control points, a card, a pencil, and a compass.
8. Instruct the participants to head first to the master map and copy from it the locations and order of the control points. Then they should proceed to the control points on a path of their choice. Upon reaching the control point, participants record the code number on their cards.
9. Start the participants at two-minute intervals. Record their starting time on their cards.
10. At the finish line, record the participant's time.
11. Compute the final score on the basis of completion time and correct sequence of code numbers.

A variation of this race is to mark only the location of the control points on the map. Allow the participants to determine the order to visit them. A further variation is to set a course time. Give each control point a value, those farther away and harder to reach receiving higher values. The participants try to accumulate the most points in the time allotted by visiting the control points and recording code numbers. Negative points are set for late returns. (For example, give 30 points for completing the course in the specified time period, with 5 points deducted for each 5 minutes overtime. 70 points should be broken down for all control points. A total of 100 points is possible.)

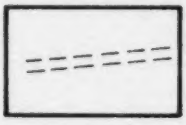
Identifying topographic map symbols

Name _____

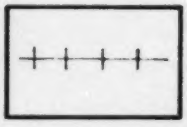
In the space provided next to each topographic map symbol, write the name of the symbol shown in the box.

1. improved light duty road

2. trail



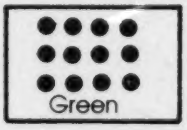
3. unimproved dirt road



4. railroad, single track

5. depression contour

6. wooded marsh

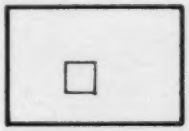


7. orchard

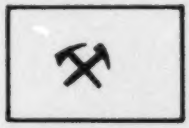
8. school

9. cemetery

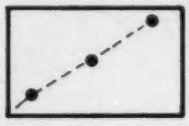
10. buildings



11. barn, building

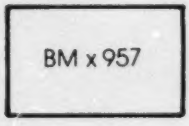


12. open pit, quarry

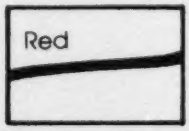


13. power transmission lines

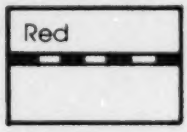
14. storage tanks



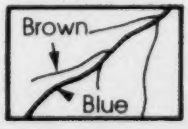
15. Benchmark 957 ft. above sea level vertical control station



16. heavy duty road

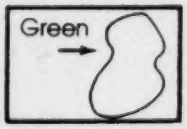


17. medium duty road 2-3 lanes



18. stream

19. pond



20. woodlands

Determining distances

Name _____

Using the map and the bar scales below, measure the following distances:

Distance **A** to **C** in miles? 1.2

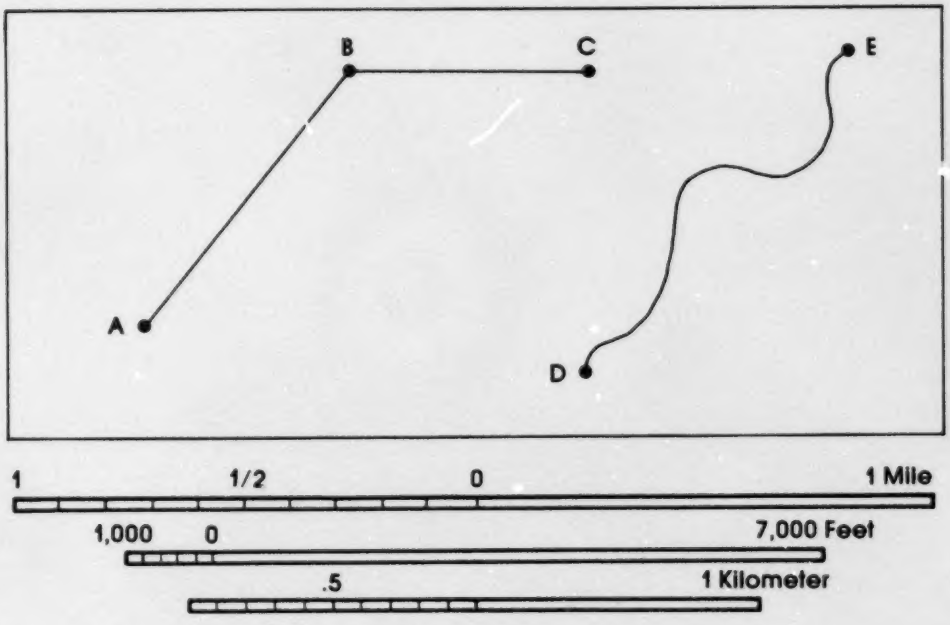
in feet? 6,336

in kilometers? 2

Distance **D** to **E** in miles? 1.1

in feet? 5,808

in kilometers? 1.83 (1.8)



Reading a topographic map

Name _____

Using the information given on this topographic map, answer the questions below.

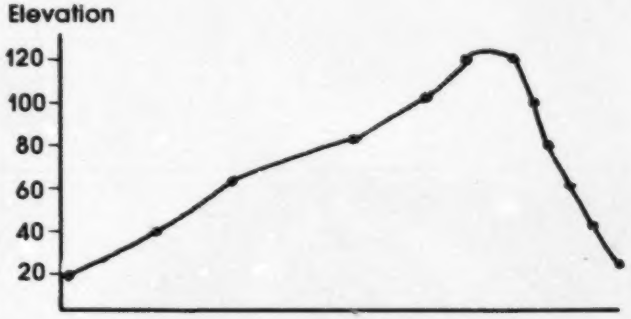
contour interval– 20 feet
index contour– 100

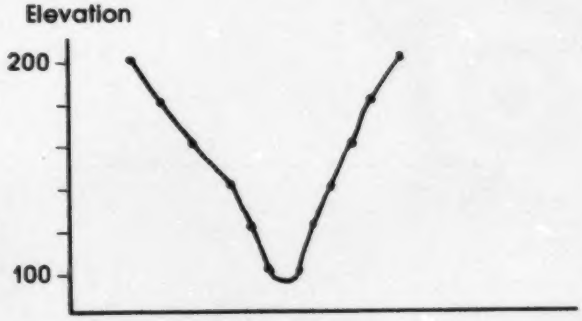
1. What is the elevation of contour line **B**? 140 feet
2. Which hill is steeper in slope – NW corner or (NE) corner? Why NE corner contour lines are closer together
3. What is the approximate elevation of point **X** in the SE corner of the map? Between 160 ft. and 180 ft.
4. What is the major topographic feature shown on this map? a valley
5. What direction is the stream flowing? SW

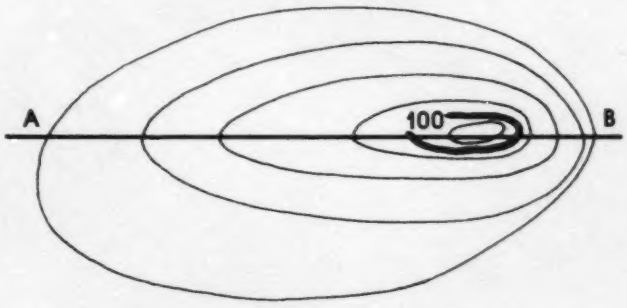
Determining topographic profiles

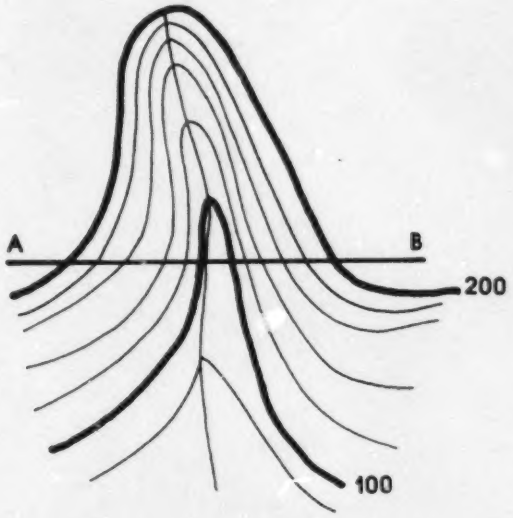
Name _____

Draw a topographic profile of the following landforms to answer the questions below.









contour interval 20 feet

What is the name of this landform? a hill

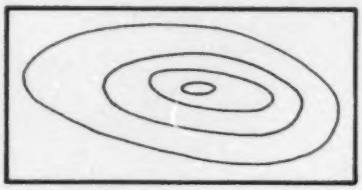
contour interval 20 feet

What is the name of this landform? a gorge or steep valley

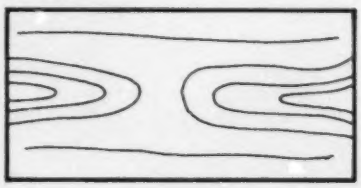
Naming topographic features

Name _____

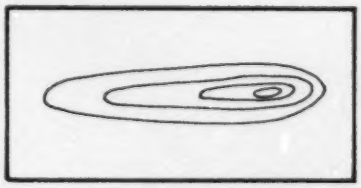
In the space provided, write the correct name of the topographic feature shown.



1. hill



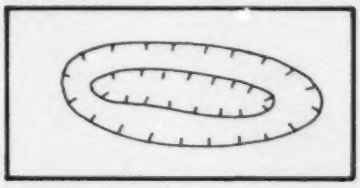
2. saddle



3. ridge

4. gorge

5. valley, stream



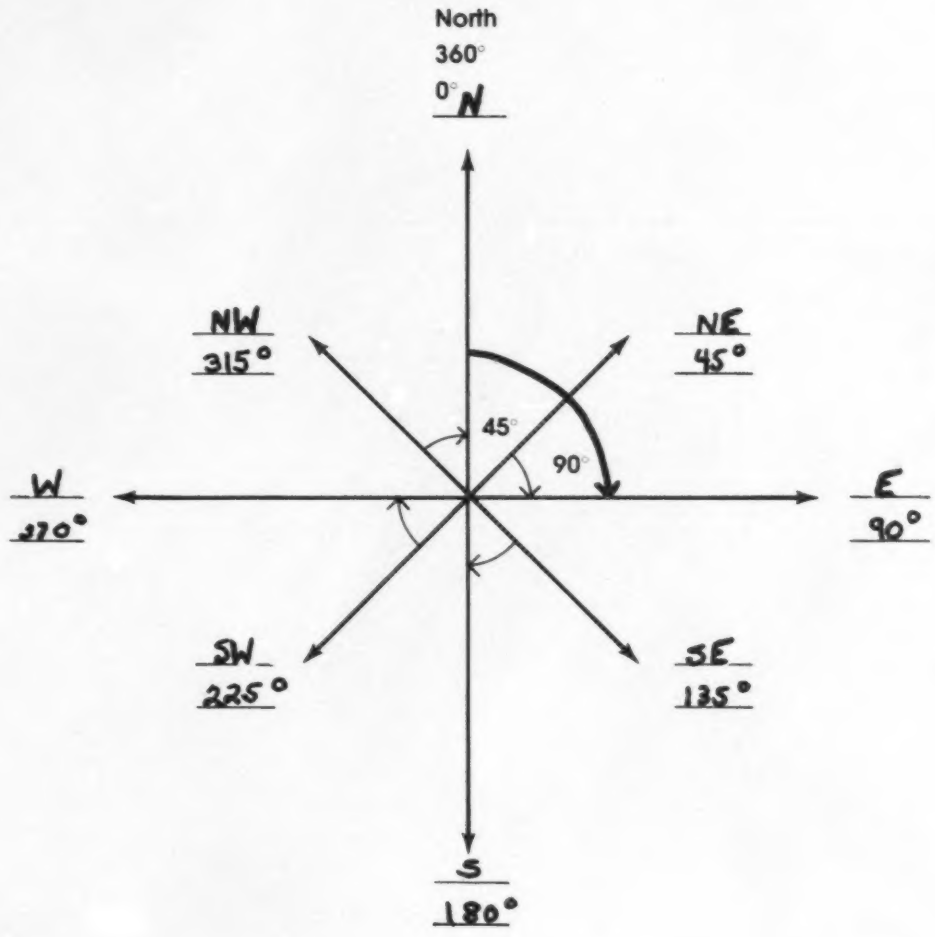
6. depression

7. steep ridge, cliff

Naming directions

Name _____

On the compass card below, fill in the correct direction name and the corresponding number of degrees.



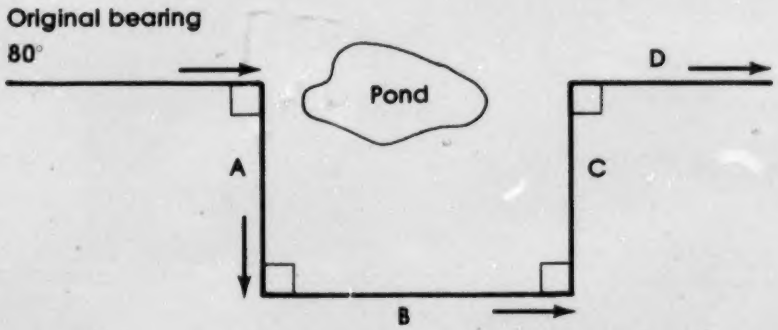
12

Avoiding obstacles

Name _____

You are traveling to a cabin following a bearing of 80° when you reach a pond. Indicate in the spaces below the bearing of points **A, B, C,** and **D.**

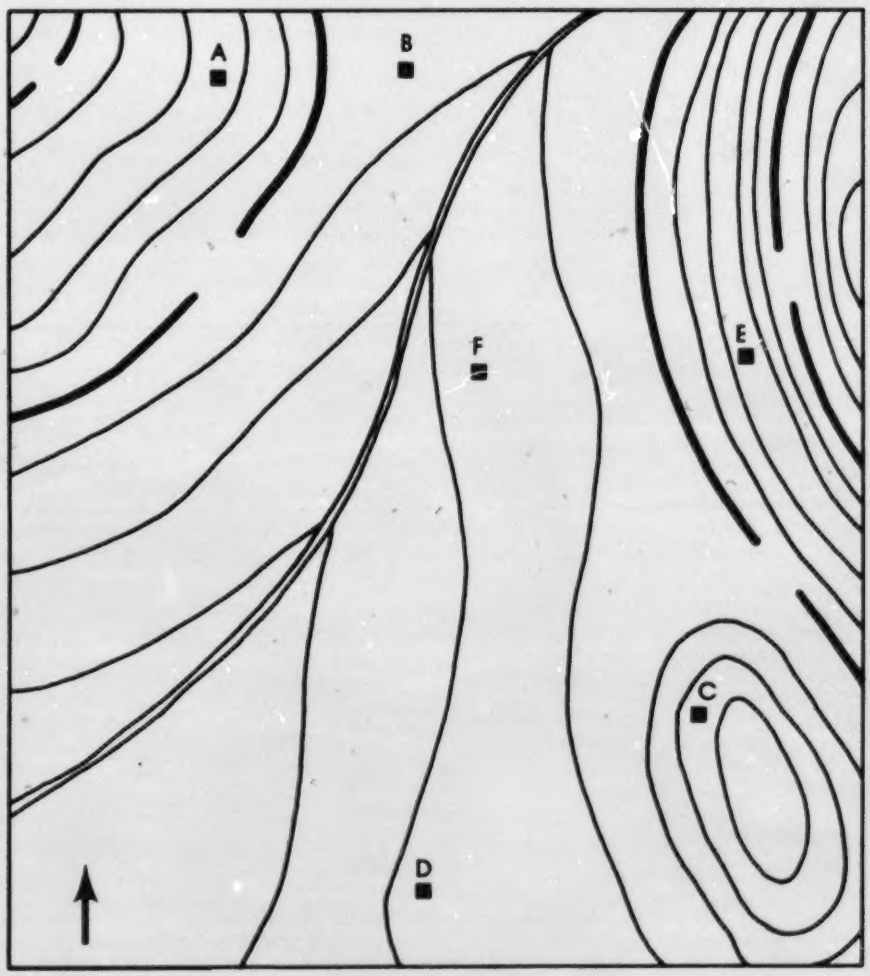
Position	Bearing in degrees
A	170°
B	80°
C	350°
D	10°



Taking bearings on a topo. map

Using an orienteering compass, a ruler, and the topographic map below, write the correct bearings in the space provided.

1. from A to B 96°
2. from B to C 164°
3. from C to D 246°
4. from D to E 39°
5. from E to F 276°



Final exam

Topographic map and compass use

Name _____

Map # _____

Fill in the blanks (4 points each).

1. What is the contour interval of this map? _____ ft.

2. What quadrangle (map area) is located to the NW?

   _____

3. The declination of this map is _____ West.

4. a) The scale of this map is _____.
   b) The map covers an area of approx. _____ sq. miles.

5. Map area to the SE is _____.

6. Map year _____.
   Why is this important?

   _____

7. What is the largest road (route number or name) shown on this map? _____

8. What is the highest elevation shown on this map?

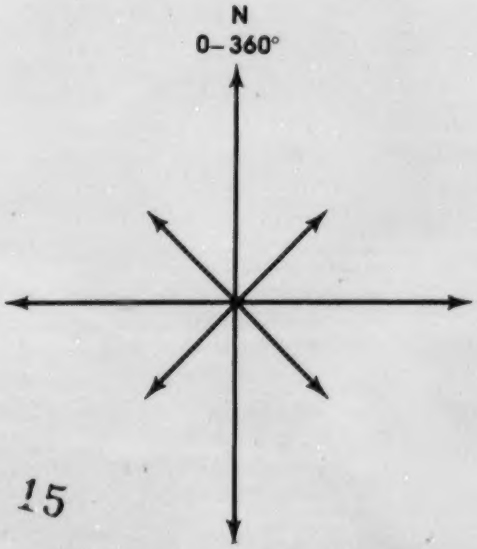
   _____ ft.

9. The dominant landform on this map is _____.

10. What is the distance from point **A** to point **B**?
    (shown by red line) _____.

11. Define **declination.**

12. Fill in the degrees **and** directions.



13. Label these hills as **steep** or **gradual**.

a)

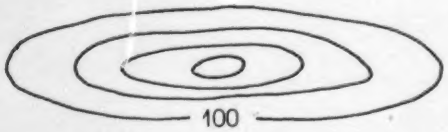
_____

b)

_____

14. What is a **contour line**?

15. **Given**: Contour Interval=20 feet.



BEAN HILL

The top of BEAN HILL lies between _____ and _____ ft.

Map symbols — Fill in the correct name for the map symbols drawn on the blackboard. Choose any **10**. (Extra credit given for naming all 12.)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

TOPOGRAPHIC MAP SYMBOLS

VARIATIONS WILL BE FOUND ON OLDER MAPS

Primary highway, hard surface

Secondary highway, hard surface

Light-duty road, hard or improved surface

Unimproved road

Road under construction, alinement known

Proposed road

Dual highway, dividing strip 25 feet or less

Dual highway, dividing strip exceeding 25 feet

Trail

Railroad: single track and multiple track

Railroads in juxtaposition

Narrow gage: single track and multiple track

Railroad in street and carline

Bridge: road and railroad

Drawbridge: road and railroad

Footbridge

Tunnel: road and railroad

Overpass and underpass

Small masonry or concrete dam

Dam with lock

Dam with road

Canal with lock

Buildings (dwelling, place of employment, etc.)

School, church, and cemetery — Cem

Buildings (barn, warehouse, etc.)

Power transmission line with located metal tower

Telephone line, pipeline, etc. (labeled as to type)

Wells other than water (labeled as to type) — Oil — Gas

Tanks: oil, water, etc. (labeled only if water) — Water

Located or landmark object; windmill

Open pit, mine, or quarry; prospect

Shaft and tunnel entrance

Horizontal and vertical control station:

Tablet, spirit level elevation — BM △5653

Other recoverable mark, spirit level elevation — △5455

Horizontal control station: tablet, vertical angle elevation — VABM △95/9

Any recoverable mark, vertical angle or checked elevation — △3775

Vertical control station: tablet, spirit level elevation — BM × 957

Other recoverable mark, spirit level elevation — × 954

Spot elevation — 17 × 7369 × 7369

Water elevation — 670 670

Boundaries: National

State

County, parish, municipio

Civil township, precinct, town, barrio

Incorporated city, village, town, hamlet

Reservation, National or State

Small park, cemetery, airport, etc.

Land grant

Township or range line, United States land survey

Township or range line, approximate location

Section line, United States land survey

Section line, approximate location

Township line, not United States land survey

Section line, not United States land survey

Found corner: section and closing

Boundary monument: land grant and other

Fence or field line

Index contour

Intermediate contour

Supplementary contour

Depression contours

Fill

Cut

Levee

Levee with road

Mine dump

Wash

Tailings

Tailings pond

Shifting sand or dunes

Intricate surface

Sand area

Gravel beach

Perennial streams

Intermittent streams

Elevated aqueduct

Aqueduct tunnel

Water well and spring

Glacier

Small rapids

Small falls

Large rapids

Large falls

Intermittent lake

Dry lake bed

Foreshore flat

Rock or coral reef

Sounding, depth curve — 10

Piling or dolphin

Exposed wreck

Sunken wreck

Rock, bare or awash; dangerous to navigation

Marsh (swamp)

Submerged marsh

Wooded marsh

Mangrove

Woods or brushwood

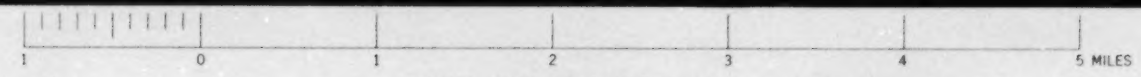
Orchard

Vineyard

Scrub

Land subject to controlled inundation

Urban area



MILE SCALE 1:62 500

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

TOPOGRAPHIC MAP INFORMATION AND SYMBOLS MARCH 1978

QUADRANGLE MAPS AND SERIES

Quadrangle maps cover four-sided areas bounded by parallels of latitude and meridians of longitude. Quadrangle size is given in minutes or degrees.

Map series are groups of maps that conform to established specifications for size, scale, content, and other elements.

Map scale is the relationship between distance on a map and the corresponding distance on the ground.

Map scale is expressed as a numerical ratio and shown graphically by bar scales marked in feet, miles, and kilometers.

NATIONAL TOPOGRAPHIC MAPS

Series	Scale	1 inch represents	1 centimeter represents	Standard quadrangle size (latitude-longitude)	Quadrangle area (square miles)
7½-minute	1:24,000	2,000 feet	240 meters	7½ × 7½ min.	49 to 70
7½ × 15-minute	1:25,000	about 2,083 feet	250 meters	7½ × 15 min.	98 to 140
Puerto Rico 7½-minute	1:20,000	about 1,667 feet	200 meters	7½ × 7½ min.	71
15-minute	1:62,500	nearly 1 mile	625 meters	15 × 15 min.	197 to 282
Alaska 1:63,360	1:63,360	1 mile	nearly 634 meters	15 × 20 to 36 min.	207 to 281
Intermediate	1:100,000	nearly 1.6 miles	1 kilometer	30 × 60 min.	1568 to 2240
U. S. 1:250,000	1:250,000	nearly 4 miles	2.5 kilometers	1° × 2° or 3°	4,580 to 8,669
U. S. 1:1,000,000	1:1,000,000	nearly 16 miles	10 kilometers	4° × 6°	73,734 to 102,759
Antarctica 1:250,000	1:250,000	nearly 4 miles	2.5 kilometers	1° × 3° to 15°	4,089 to 8,336
Antarctica 1:500,000	1:500,000	nearly 8 miles	5 kilometers	2° × 7½°	28,174 to 30,462

CONTOUR LINES SHOW LAND SHAPES AND ELEVATION

The shape of the land, portrayed by contours, is the distinctive characteristic of topographic maps.

Contours are imaginary lines following the ground surface at a constant elevation above or below sea level.

Contour interval is the elevation difference represented by adjacent contour lines on maps.

Contour intervals depend on ground slope and map scale. Small contour intervals are used for flat areas; larger intervals are used for mountainous terrain.

Supplementary dotted contours, at less than the regular interval, are used in selected flat areas.

Index contours are heavier than others and most have elevation figures.

Relief shading, an overprint giving a three-dimensional impression, is used on selected maps.

Orthophotomaps, which depict terrain and other map features by color-enhanced photographic images, are available for selected areas.

COLORS DISTINGUISH KINDS OF MAP FEATURES

Black is used for manmade or cultural features, such as roads, buildings, names, and boundaries.

Blue is used for water or hydrographic features, such as lakes, rivers, canals, glaciers, and swamps.

Brown is used for relief or hypsographic features—land shapes portrayed by contour lines.

Green is used for woodland cover, with patterns to show scrub, vineyards, or orchards.

Red emphasizes important roads and is used to show public land subdivision lines, land grants, and fence and field lines.

Red tint indicates urban areas, in which only landmark buildings are shown.

Purple is used to show office revision from aerial photographs. The changes are not field checked.

INDEXES SHOW PUBLISHED TOPOGRAPHIC MAPS

Indexes for each State, Puerto Rico and the Virgin Islands of the United States, Guam, American Samoa, and Antarctica show available published maps. Index maps show quadrangle location, name, and survey date. Listed also are special maps and sheets, with prices, map dealers, Federal distribution centers, and map reference libraries, and instructions for ordering maps. Indexes and a booklet describing topographic maps are available free on request.

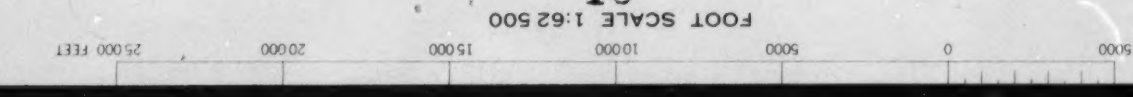
HOW MAPS CAN BE OBTAINED

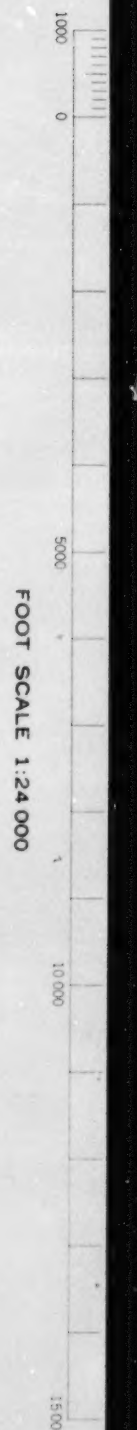
Mail orders for maps of areas east of the Mississippi River, including Minnesota, Puerto Rico, the Virgin Islands of the United States, and Antarctica should be addressed to the Branch of Distribution, U. S. Geological Survey, 1200 South Eads Street, Arlington, Virginia 22202. Maps of areas west of the Mississippi River, including Alaska, Hawaii, Louisiana, American Samoa, and Guam should be ordered from the Branch of Distribution, U. S. Geological Survey, Box 25286, Federal Center, Denver, Colorado 80225. A single order combining both eastern and western maps may be placed with either office. Residents of Alaska may order Alaska maps or an index for Alaska from the Distribution Section, U. S. Geological Survey, Federal Building-Box 12, 101 Twelfth Avenue, Fairbanks, Alaska 99701. Order by map name, State, and series. On an order amounting to $300 or more at the list price, a 30-percent discount is allowed. No other discount is applicable. Prepayment is required and must accompany each order. Payment may be made by money order or check payable to the U. S. Geological Survey. Your ZIP code is required.

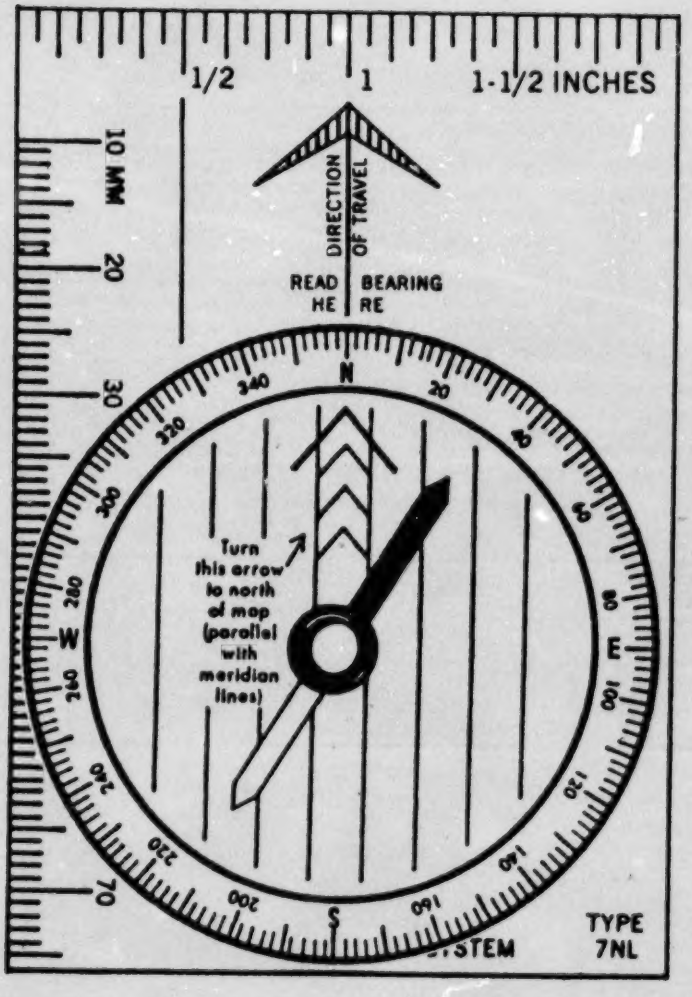
Sales counters are maintained in the following U. S. Geological Survey offices, where maps of the area may be purchased in person: 1200 South Eads Street, Arlington, Va.; Room 1028, General Services Administration Building, 19th & F Streets NW, Washington, D. C.; 1400 Independence Road, Rolla, Mo.; 345 Middlefield Road, Menlo Park, Calif.; Room 7638, Federal Building, 300 North Los Angeles Street, Los Angeles, Calif.; Room 504, Custom House, 555 Battery Street, San Francisco, Calif.; Building 41, Federal Center, Denver, Colo.; Room 1012, Federal Building, 1961 Stout Street, Denver Colo.; Room 1C45, Federal Building, 1100 Commerce Street, Dallas, Texas; Room 8105, Federal Building, 125 South State Street, Salt Lake City, Utah; Room 1C402, National Center, 12201 Sunrise Valley Drive, Reston, Va.; Room 678, U. S. Court House, West 920 Riverside Avenue, Spokane, Wash.; Room 108, Skyline Building, 508 Second Avenue, Anchorage, Alaska; and Federal Building, 101 Twelfth Avenue, Fairbanks, Alaska.

Commercial dealers sell U. S. Geological Survey maps at their own prices. Names and addresses of dealers are listed in each State index.

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1978



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